

**Attachment B**  
**CONSTRUCTION WORKER INHALATION RATE**  
**DRAFT**

The arithmetic mean and 99<sup>th</sup>-percentile construction worker inhalation rates discussed in this attachment were obtained from the *Update to "Exposure Factors Handbook"*, Office of Research and Development, National Center for Environmental Assessment, U.S. Environmental Protection Agency, EPA/600/P-95/002Fa, August 1997, Volume I – General Factors, Chapter 5 – Inhalation.

Several key and relevant inhalation rate studies are referenced in the above document. The draft construction worker inhalation rates identified below are based on two key inhalation rate studies:

- Linn, W.S.; Shamoo, D.A.; Hackney, J.D. (1992) *Documentation of activity patterns in "high-risk" groups exposed to ozone in the Los Angeles area. In: Proceedings of the Second EPA/AWMA Conference on Tropospheric Ozone, Atlanta, Nov. 1991. pp. 701-712. Air and Waste Management Assoc., Pittsburgh, PA.*

This study used two groups to estimate construction worker inhalation rates:

- Panel 1 – consisted of 20 healthy adult outdoor workers (15 males, 5 females, ages 19-50 years), and
  - Panel 7 – consisted of 7 construction workers (7 males, ages 26-34 years).
- Linn, W.S.; Spier, C.E., Hackney, J.D. (1993) *Activity patterns in ozone-exposed construction workers. J. Occ. Med. Tox. 2(1):1-14.*

This study used a group of 19 construction workers who performed heavy outdoor labor before and during a typical work shift. These workers included laborers, iron workers and carpenters employed at a hospital/medical office construction site in suburban Los Angeles.

Table 1 below presents a summary of the Mean and 99<sup>th</sup>-Percentile Inhalation Rate data results and weighted average of the two key inhalation rate studies referenced above. Table 2 presents a summary of the same data and weighted average, but by activity level.

Using a default exposure time (10 hours) for outdoor inhalation for a construction worker, the following information breaks out possible activity levels during a 10-hour day:

- 2 hours of Slow Activity as defined for a construction worker
- 4 hours of Medium Activity as defined for a construction worker
- 4 hours of Fast Activity as defined for a construction worker

Using the information from Table 3 below, which is based on the Linn studies and the activity level scenario above, the Average Construction Worker Inhalation Rate would be 1.8 cubic meters/hour (m<sup>3</sup>/hr).

**Table 1. Inhalation Rate by Mean and 99<sup>th</sup>-Percentile for Construction Worker**

Group	Number of Individuals	Inhalation Rate (m <sup>3</sup> /hr)	
		Mean*	99 <sup>th</sup> Percentile
Linn et al., 1992			
Adult Outdoor Workers	20	0.78	2.46
Construction Workers	7	1.50	4.26
Linn et al., 1993			
General Construction Worker/Laborers	5	1.44	3.66
Iron Workers	3	1.62	3.24
Carpenters	11	1.86	4.14
Weighted Average		1.3	3.3

\* Arithmetic average

**Table 2. Inhalation Rate by Activity Level for Construction Worker**

Group	Number of Individuals	Inhalation Rate (m <sup>3</sup> /hr)		
		Slow Activity	Medium Activity	Fast Activity
Linn et al., 1992				
Adult Outdoor Workers	20	0.72	1.02	3.06
Construction Workers	7	1.26	1.50	1.68
Linn et al., 1993				
General Construction Worker/Laborers	5	1.2	1.56	1.68
Iron Workers	3	1.38	1.86	2.10
Carpenters	11	1.62	2.04	2.28
Weighted Average		1.1	1.5	2.5

**Table 3. Recommended Average Inhalation Rate for Construction Worker\***

Activity	Hours Spent (hr)	Inhalation Rate (m <sup>3</sup> /hr)
Slow	2	1.1
Medium	4	1.5
Fast	4	2.5
<b>Average Inhalation Rate</b>		<b>1.8</b>

\* Example of possible work activities during a 10-hour workday